
Longitudinal Study of Delinquency, Drug Use, Sexual Activity, and Pregnancy Among Children and Youth in Three Cities

DAVID HUIZINGA, PhD
ROLF LOEBER, PhD
TERENCE P. THORNBERRY, PhD

authors and do not necessarily represent the views or policies of the U.S. Government, its agencies, or of the MacArthur Foundation.

Synopsis.....

Dr. Huizinga is a Research Associate at the Institute of Behavioral Science, University of Colorado. Dr. Loeber is an Associate Professor at the Western Psychiatric Institute and Clinic, University of Pittsburgh. Dr. Thornberry is a Professor in the School of Criminal Justice, The University at Albany, State University of New York. The research teams involved in the research reported in this paper include Dr. Anne Weiher and Dr. Finn Esbensen, University of Colorado; Dr. Magda Loeber and Dr. Welmoet Van Kammen, University of Pittsburgh; and Dr. Alan Lizotte, Dr. Marvin Krohn, and Dr. Carolyn Smith, the University at Albany.

Using data from a collaborative program of research, this paper examines the prevalence of delinquency, alcohol and drug use, sexual intercourse, and pregnancy among youth in three urban settings. The findings indicate that a substantial portion of adolescents are involved in these behaviors. There are indications that for many youth the initiation of delinquency and drug use is occurring before the teenage years. There are also indications that all of these behaviors are often co-occurring, suggesting that comprehensive intervention programs may be required. Importantly, the high rate of sexual activity and pregnancy, combined with alcohol and drug use, suggests that greater attention to this combination of behaviors is needed.

The major support for this research is provided by the U.S. Office of Juvenile Justice and Delinquency Prevention, with supplemental funding from the National Institute on Drug Abuse, National Institute of Mental Health, National Science Foundation, Centers for Disease Control and Prevention, and the John D. and Catherine T. MacArthur Foundation. The opinions and points of view expressed in this article are those of the

PRIOR RESEARCH INDICATES that many variables correlate with delinquency, and that many factors tend to increase the risk of subsequent delinquent behavior. Among these risk factors are birth trauma, child abuse and neglect, ineffective parental discipline, family disruptions, conduct disorder and hyperactivity in children, school failure, learning disabilities, negative peer influences, limited employment opportunities for adults, inadequate housing, and residence in high crime neighborhoods. We also know, however, that neither correlates nor risk factors can be equated with causal factors.

Why Longitudinal Research Is Needed

Overall, research findings support the conclusion that no single cause accounts for all episodes of delinquency, and no single pathway or set of life experiences leads to a life of crime. To date, however, we have not clearly identified the different developmental pathways that lead to delinquency nor the factors that start or maintain someone on one of these paths. One of the best ways to understand these developmental processes is by conducting studies that follow and assess people periodically. Longitudinal studies, in contrast to cross-sectional studies, help to unravel developmental progressions, identifying which factors come earlier and which later in the development of delinquent behavior.

In fact, researchers have not yet been able to discriminate well between causal and other factors. Nor have we been able to delineate which constellations of causes are most crucial in explaining delinquency. Indeed, it is not easy to determine causality for most human behavior, especially in the natural environment where, in contrast to the laboratory, controls are not easy to achieve. We cannot simply presume that any child who experiences one of the risk factors (child abuse, for example) will automatically become delinquent; many children who experience abuse never engage in delinquent behavior. Each person brings to a given situation unique personal characteristics that have been influenced by a host of factors in the arenas of the family, school, peer context, and the community environment.

Social scientists and policy makers are now in general agreement that these longitudinal studies are the best way to gain information on the causes of delinquency (1,2). These studies can identify developmental sequences in delinquent behavior within the context of other developmental social and psychological processes that are presumed to cause this behavior. Understanding these developmental processes and sequences provides the information needed to develop more effective intervention strategies. Although absolute identification of causes can not be established with longitudinal designs

Delinquency and Drug Use Measures in Longitudinal Study of Children and Youth in Three Cities

Street Delinquency Offenses

Youth measure:

1. Theft, \$50 - \$100
2. Theft, more than \$100
3. Theft, motor vehicle
4. Burglary
5. Aggravated assault
6. Robbery
7. Rape
8. Gang fighting
9. Purse snatching, pickpocket
10. Theft from an automobile
11. Sold marijuana
12. Sold hard drugs
13. Fencing (selling, buying stolen goods)

Child measure:

1. Theft of bicycle or skateboard
2. Theft from school
3. Burglary
4. Theft from an automobile
5. Hit an adult at school
6. Physical fights with other kids
7. Purse snatching, pickpocket

Alcohol and Drug Use

Alcohol use:

1. Drunk beer
2. Drunk wine
3. Drunk hard liquor

Marijuana use:

1. Used marijuana or hashish

Other drug use:

1. Used tranquilizers
2. Used barbiturates
3. Used amphetamines
4. Used hallucinogens
5. Used cocaine (other than crack)
6. Used crack
7. Used heroin
8. Used angel dust or PCP

(this requires true experimental studies), by establishing temporal order, they can establish which factors are not causes and identify those factors most likely to be true causes of delinquency.

Overview of the Program of Research

A recent example of longitudinal research is the Program of Research on the Causes and Correlates of Delinquency of the U.S. Office of Juvenile Justice and Delinquency Prevention. Three research teams participate in this program of research, which was launched in the fall of 1986. They are located at the University at Albany, University of Colorado, and University of Pittsburgh, with study sites in Rochester, NY, Denver, CO, and Pittsburgh, PA.

The research teams collaborated extensively in the design of the studies, the identification of key theoretical concepts, and the development of "core" measures for these concepts. The culmination of this effort is the use of a body of common measurements in the surveys of the three projects. The following are examples of content areas addressed in the core measures:

- official and self-reports of delinquent behavior;
- self-reports of drug use;
- characteristics of the community and neighborhood;
- demographic characteristics of the family;
- parental attitudes and child rearing practices;
- youth and child attitudes, school performance;
- perceived consequences of delinquency; and
- peer delinquency and conventional activities.

These collaborative efforts are a milestone in criminological research in that they constitute the largest shared measurement approach ever achieved in delinquency research. Under this program, we are able to aggregate data across projects and also to replicate findings across sites to ensure that findings apply in more than one specific site. In addition to the common measures, each project is also collecting unique measurements that are expected to further enhance the findings from that site.

Study Designs and Samples

In each of the three projects a sample of youngsters was selected and is being followed over time. The purpose is to chart the social and psychological development of these youngsters and then relate it to the development of delinquency, drug use, and other problem behaviors. To date, the samples have been followed for 5 years, and continuing assessment of the youths

during the next several years is planned. This report uses information from the first 3 years of data collection.

Each study is following a large number of youngsters. In Denver the 1,500 subjects are divided equally among boys and girls. At the beginning of the study, there were equal numbers of 7-, 9-, 11-, 13-, and 15-year olds. In Pittsburgh, 1,500 boys were divided equally among first, fourth, and seventh graders at year 1. In Rochester, of 1,000 subjects, 75 percent are boys and 25 percent are girls. They were divided equally among seventh and eighth graders at year 1.

Each study oversampled youngsters at high risk for serious delinquency and drug use to obtain enough serious, chronic offenders for study. (Risk was determined by residence in areas characterized by social and economic conditions linked to delinquency or high crime rates, or both.) The results reported in this paper, however, have been weighted to represent the general child and youth populations in major segments of the three cities. Although each project covers large geographic areas, the sampling designs of the three studies provide somewhat different coverage of the cities involved. For Rochester, the results are representative of the whole city; for Pittsburgh, results are representative of public schools; and for Denver, the results are representative of specific high-risk areas.

The project's researchers collect comprehensive information on each subject, mostly in face-to-face interviews conducted with each youngster and his or her primary caretaker — usually the mother. In Denver, the interviews are conducted annually and in Pittsburgh and Rochester, semiannually. For this report, the Pittsburgh and Rochester data have been combined into annual periods, and the results cover the first 3 years of data collection. All three studies have had 90 percent or better rates of subject retention during this period. Extensive analysis indicates that the respondents who remain in the studies are representative of the original samples.

Although many measures of delinquency and drug use are possible in these studies, two summary indices are used in this article. "Street Crimes" is an index that combines 13 serious forms of delinquency such as robbery, burglary, major theft, gang fights, and the like (see box). These offenses are currently of great concern and have been shown in previous research to be of greater seriousness in the view of the public at large (3). Indexes of drug use include use of alcohol, use of marijuana, and an index that combines the use of eight "harder" drugs. For some analyses, a measure that combines the use of marijuana and the "hard" drugs is used. Different versions of these scales are used for the children (ages 6-10) and youth respondents (ages 11-17), which limit their comparability. The content of the child delin-

Figure 1. Annual prevalence rates for street crimes by age, for males

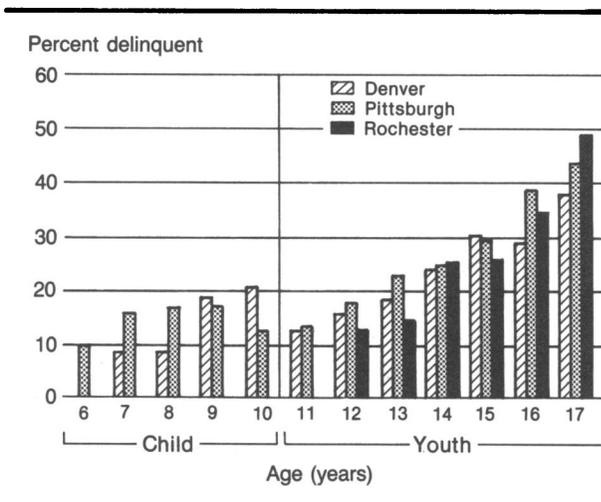
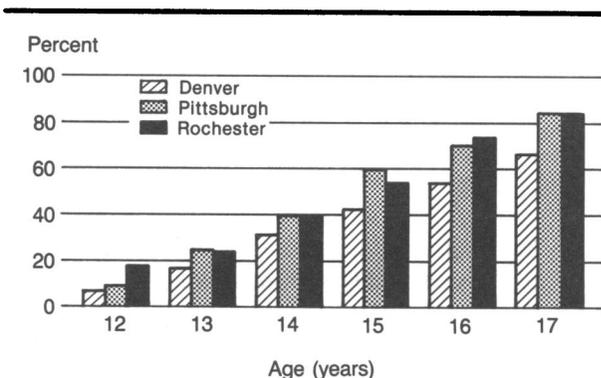


Figure 2. Rates of sexual intercourse by age



NOTE: Pittsburgh sample has only males.

Table 1. Percentages of children and youth committing street crimes, by age group and sex

Sex	Child (ages 6-10)		Youth (ages 11-17)		
	Denver	Pittsburgh	Denver	Pittsburgh	Rochester
Males	14	16	22	20	25
Females	7	na ¹	8	na ¹	14

¹Estimates unavailable due to samples or measurement.

quency measures, however, is similar to the content of the youth scales and may, perhaps, be viewed as precursors to later behaviors. Only alcohol and marijuana use are included in the children's drug use measure. Information about sexual activity and pregnancy is also obtained from the youth samples.

All of the measures used in this report — delinquency, drug use, sexual activity, and pregnancy — are based on self-reports of behavior obtained during in-

Table 2. Percentages of children and youth using alcohol, marijuana, and other drugs in three cities, by sex and age

Sex and age (years)	Alcohol			Marijuana			Other drugs		
	Denver	Pittsburgh	Rochester	Denver	Pittsburgh	Rochester	Denver	Pittsburgh	Rochester
Males:									
7	15.3	20.0	na ¹	1.2	na ¹				
9	14.8	27.0	na ¹	1.3	na ¹				
11	11.1	25.0	na ¹	0.9	0.9	na ¹	na ¹	na ¹	na ¹
13	25.1	49.9	19.1	9.8	3.7	6.9	0.6	0.0	0.0
15	40.9	57.3	45.7	21.4	11.6	15.8	6.3	2.6	1.7
17	56.7	64.1	67.6	22.7	25.3	34.4	7.1	7.4	10.2
Females:									
7	9.7	...	na ¹	0.7	...	na ¹	na ¹	...	na ¹
9	9.7	...	na ¹	1.1	...	na ¹	na ¹	...	na ¹
11	10.1	...	na ¹	2.4	...	0.9	0.3	...	na ¹
13	28.7	...	26.2	12.1	...	11.8	1.4	...	0.0
15	38.8	...	46.6	17.9	...	18.7	5.0	...	1.3
17	45.6	...	36.3	18.7	...	36.3	3.1	...	0.0

¹Estimates unavailable due to samples or measurement.

'These collaborative efforts are a milestone in criminological research in that they constitute the largest shared measurement approach ever achieved in delinquency research. Under this program, we are able to aggregate data across projects and also to replicate findings across sites to ensure that findings apply in more than one specific site'

interviews of children and youth. The self-report method is frequently used in delinquency research and has been found to have acceptable validity and reliability. This report is descriptive in nature and focuses on prevalence rates (proportion of persons) engaging in the various behaviors included in the delinquency and drug use measures. Information about frequency of delinquent behavior and drug use and the relationship of demographic and other personal and social characteristics to these behaviors is available in other program and project reports of the Office of Juvenile Justice and Delinquency (4).

Findings

Rates of delinquency, drug use, sexual activity, and pregnancy. This section presents descriptive data about the extent of these behaviors in the three study populations.

Delinquency. The three projects use identical items to measure self-reported rates of delinquency and drug use. Table 1 presents the prevalence rate, or the per-

centage of subjects who commit street crimes, in each city. Data on "youth" samples refer to subjects ages 11 to 17, while data on "child" samples refer to subjects ages 6 to 10.

Within age and sex categories there is a very high degree of similarity in these prevalence rates across cities. As expected, males report more involvement in street crimes than females. About one-quarter of the older males, but only about one-tenth of the older females, report committing street offenses. Older subjects report more involvement than younger subjects. The prevalence rates for males across the age range of 6-17 is given in figure 1. As can be seen, the annual rate of street offending continues to increase up to the age of 17. It is interesting to note, however, that about 15 percent of the youngest boys in Denver and Pittsburgh report some involvement in the behaviors included in the child street crime measure. The rate of involvement in these precursors to serious forms of delinquency by the youngest subjects indicates a very early age when these behaviors are initiated.

Drug use. Rates of drug use are also quite high. As can be seen in table 2, alcohol use begins early and by age 17, more than half of the boys and more than one-third of the girls use alcohol regularly. Marijuana use begins later, and fewer youth use this drug; about one-quarter of the subjects use marijuana at age 17. Use of other drugs begins even later, and prevalence rates never exceed 10 percent. Although use of marijuana and other drugs is of concern, clearly alcohol remains the "drug of choice" among American adolescents, and greater attention to the abuse of alcohol seems warranted.

Sexual activity and pregnancy. There is a high rate of sexual intercourse and pregnancy reported by the

youth samples of these studies. As can be seen in table 3, when these adolescents were in the 13–17-year-old age range, roughly half the boys and, depending on the site, one-third to one-half the girls were sexually active.

Not surprisingly, there is a general increase in sexual activity with increasing age. As these youths matured from ages 11–15, in the first year of the studies, to 13–17, in the third year of the studies, roughly 10 to 13 percent initiated sexual activity each year, and the vast majority of those who became active remained active in the following years. The prevalence of sexual activity, by age, is illustrated in figure 2. The proportion rose continuously across the age range, and by age 17, almost 70 percent of the sample in Denver and 85 percent of the sample in Pittsburgh and Rochester were sexually active.

The adolescent females in these studies also reported a relatively high rate of pregnancy. Among the oldest cohorts, 42 percent of the girls in Denver and 29 percent of those in Rochester, by age 17, reported being pregnant at least once.

Overlap of problem behaviors

Delinquency and substance use. Substance use and involvement in other delinquent behavior are clearly interrelated. As reported in other studies (5,6) and found in these three cities, a large proportion of serious delinquents are drug users and, conversely, a large proportion of serious drug users are delinquent. However, the relationship does not appear to be symmetric. Dividing the subjects into four groups — nondelinquent and nondrug using, delinquent but not drug using, drug using but not delinquent, and both delinquent and drug using — the proportion of children and youth who fall into these groups is illustrated in table 4.

For children, drug use is measured by alcohol or marijuana use, and in both Pittsburgh and Denver the largest proportion of these youngsters are neither delinquent (44 percent) nor drug using (65 percent). Among those involved in some form of delinquency, less than 40 percent are using alcohol or marijuana. However, 65 percent of those experimenting with these drugs are also delinquent.

A similar but even stronger finding holds for the adolescents, where drug use is measured by use of marijuana or other drugs. Overall, a little more than one-third of the adolescents are not delinquent and do not use drugs, about one-quarter or less of the delinquents are using drugs, but almost all of the drug users are involved in some kind of delinquency. Thus, it appears that at these ages most drug users are delinquent, but there are many delinquents who are not using drugs.

Table 3. Percentages of 13-17-year-olds in three cities who were sexually active in 1990

Sex	Denver	Pittsburgh	Rochester
Males	46	57	60
Females	35	na ¹	50

¹Estimates unavailable due to samples or measurement.

Table 4. Overlap of delinquency and drug use for children and adolescents (percentages)

Delinquency	Drug use	Child		Youth		
		Denver	Pittsburgh	Denver	Pittsburgh	Rochester
No	No ...	65.1	44.3	36.0	35.4	43.7
Yes	No ...	25.5	34.4	48.3	59.9	39.1
No	Yes ...	3.0	7.3	0.9	0.1	1.1
Yes	Yes ...	6.2	13.8	14.8	4.6	16.0
Percentage of delinquents who are drug users		19.6	28.6	23.5	7.2	29.0
Percentage of drug users who are delinquent		67.4	65.4	94.2	97.9	93.6

Also, in data not shown, when the substance use–delinquency relationship is examined over time, prior increases in substance use are found to have a larger impact on subsequent increases in delinquency, while prior increases in delinquency have a somewhat smaller impact on subsequent increases in drug use. The reverse is also true — prior decreases in substance use have a greater impact on decreases in delinquency than prior decreases in delinquency have on decreases in drug use.

Delinquency, drug use, sexual activity, and pregnancy. As noted previously, fairly high rates of sexual activity and pregnancy are reported by these subjects. To examine the overlap of delinquency, alcohol and drug use, sexual intercourse, and pregnancy, data from subjects of the Denver and Rochester studies, who were 13–17 years old in 1989, are analyzed. To simplify the presentation, alcohol and drug use have been combined into a single category.

Table 5 presents data on the overlap of sexual activity, delinquency, and alcohol–drug use, giving the percentage of youth who are active in different combinations of these behaviors. For example, looking at the Denver data in table 5, adding together the values for the total sample for the four rows that have a “yes” for sexual activity, we see that 42.5 percent of the youth respondents are sexually active. However, only 4.4 percent of youth are involved in sexual activity exclusively, and

Table 5. Overlap of delinquency, alcohol or drug use, or both, sexual activity, and pregnancy among youth at ages 13-17 in 1989 in two cities (percentages)

Delinquency	Alcohol-drug use	Sexual activity	Total sample	Males	Females ¹		
					Not pregnant	Pregnant	
<i>Denver</i>							
No	No	No	20.7	18.5	25.8	0	
Yes	No	No	23.2	21.1	28.4	0	
No	Yes	No	2.1	1.7	2.9	0	
Yes	Yes	No	11.6	10.7	14.1	0	
No	No	Yes	4.4	3.7	4.1	13.3	
Yes	No	Yes	13.8	16.3	8.8	29.5	
No	Yes	Yes	1.6	2.3	.6	2.9	
Yes	Yes	Yes	22.7	25.7	15.3	54.3	
<i>Rochester</i>							
No	No	No	27.3	23.5	36.8	10.6	
Yes	No	No	6.7	6.6	8.0	0.0	
No	Yes	No	6.1	4.7	9.0	0.0	
Yes	Yes	No	5.5	6.0	4.0	19.7	
No	No	Yes	10.9	9.0	11.7	19.4	
Yes	No	Yes	8.6	10.3	2.1	32.3	
No	Yes	Yes	5.6	6.1	2.8	17.4	
Yes	Yes	Yes	29.4	33.9	25.5	20.6	

¹All of these girls report being sexually active during the prior year.

22.7 percent are involved in all three kinds of behaviors.

In this table, females have been divided into not-pregnant and pregnant groups, so that the overlap of pregnancy with other behaviors can be examined. Sexual activity is strongly related to involvement in both delinquency and drug use. That is, although there are many delinquents and alcohol-drug users who are not sexually active, the majority of both boys and girls who are sexually active are also involved in delinquency, alcohol-drug use, or both.

Similarly, the majority of girls who report being pregnant also report involvement in delinquency, alcohol-drug use, or both, and more than half report alcohol-drug use. Although these data cannot confirm alcohol or drug use during pregnancy, and further work is underway to examine this issue, it seems likely that a fair proportion of the pregnant adolescents are using alcohol or other drugs while pregnant. This is particularly likely since all of the data reported in table 5 refer to the same calendar year. This observation may provide some concern because of the possible health consequences for the children of these young mothers.

Temporal ordering. An advantage of the longitudinal design of this program of research is the ability to examine the temporal ordering of the initiation or development of the problem behaviors examined. Consistent with other studies (5,6) and with the findings reported previously, involvement in minor delinquency,

in general, appears to precede involvement in alcohol or drug use, even in the preadolescent group. As noted previously, however, changes in drug use appear to have a stronger effect on subsequent changes in delinquency, than vice-versa. Also, in general, alcohol use precedes use of other drugs. In Denver and Pittsburgh, sexual activity is also preceded by at least some delinquent behavior. In Rochester, however, precocious sexual activity most frequently precedes even minor delinquency. Thus, there does not seem to be an invariant sequencing of these behaviors across persons and sites, and different youth appear to initiate these behaviors in different orders. In all three sites, however, minor offending and sexual intercourse most often precede more serious delinquent offending as well as marijuana and other illicit drug use.

Discussion

A number of common themes run through the results reported in this article. First, it is important to note that almost all of the findings are replicated across the three sites, thus giving some credence to the generality of the findings. Second, delinquency and drug use are typically thought of as teenage problems. Nevertheless, there is a clear indication that for some youth, the onset of these behaviors is occurring at much earlier ages, before the teenage years begin. Because early initiation may lead to more serious and extensive delinquent or

drug using careers, prevention and intervention efforts are needed early in life. Waiting until the high school years may make it extremely difficult to intervene successfully in behavior patterns already entrenched.

Third, there is a consistent finding of the co-occurrence of the problem behaviors. Most drug users are also delinquent. The majority of sexually active youth and pregnant adolescents are also delinquent, use alcohol or drugs, or both. Thus for many youth, intervention programs need to be comprehensive and to deal simultaneously with multiple co-occurring problem behaviors.

Of particular concern is the relatively high rate of sexual intercourse and pregnancy reported by the adolescent respondents in these studies, and the fact that initiation of sexual activity is occurring at younger ages. These sexually active youngsters, who also are often involved in delinquency and alcohol-drug use, are at high risk for sexually transmitted diseases, including AIDS, and of becoming pregnant. The high probability of alcohol or drug use during pregnancy and the fact that infants of teenage mothers are often of low birth weight suggests not only problems for the children of these young mothers, but also implies higher than average medical costs for these children. A recent estimate of the total costs associated with teenage childbearing is more than \$20 billion annually (7). The health risks and costs associated with early sexual experience suggest that greater attention to this issue is clearly needed.

Finally, it should be noted that a description of the early initiation and relatively high rates of overlapping problem behaviors, such as that presented in this paper,

is helpful in understanding the scope of these problems. Understanding the full developmental sequences of the causes, correlates, and consequences of these behaviors and the behaviors themselves, is, however, quite a different matter. By following the young respondents in these studies through young adulthood, this ongoing program of research can help build the knowledge base needed to understand more fully the developmental pathways that lead both to problem behavior and to successful outcomes. This knowledge can lead to the identification and timing of more effective prevention and intervention strategies, and this possibility underscores the importance of longitudinal research initiatives such as the one described in this paper.

References.....

1. Farrington, D. P., Ohlin, L. O., and Wilson, J. Q.: Understanding and controlling crime. Springer-Verlag, New York, 1986.
2. Tonry, M., Ohlin, L. O., and Farrington, D. P.: Human development and criminal behavior. Springer-Verlag, New York, 1991.
3. Wolfgang, M. E., Figlio, R. M., Tracy, P., and Singer, S. I.: The National Survey of Crime Severity. The Center for Studies in Criminology, University of Pennsylvania. U.S. Government Printing Office, Washington, DC, 1985.
4. Urban delinquency and drug use, edited by D. Huizinga, T. Thornberry, and R. Loeber. Office of Juvenile Justice and Delinquency Prevention, Washington, DC, 1992.
5. Elliott, D. S., Huizinga, D., and Menard, S. M.: Multiple problem youth. Springer-Verlag, New York, 1989.
6. White, H.: The drug use-delinquency connection in adolescence. *In* Drugs, crime, and the criminal justice system, edited by R. Weisheit. Anderson Publishing Co., Cincinnati, OH, 1990, pp. 215-256.
7. Voydanoff, C. P., and White, M. B.: The adolescent family life act: content, findings, and policy recommendations for pregnancy prevention programs. *J Consult Clin Psychol* 20: 58-70 (1990).